Source Size from Antinuclei and Search for Antihypertriton

*David Hardtke, David R. Schmierer**
Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720

Hank Crawford
Space Sciences Laboratory, Berkeley, CA 94720

and the STAR Collaboration

Using the STAR detector, we have measured the yields of antiprotons, antideuterons, and antihelions[1]. The production rates for composite nuclei and antinuclei can be related to the geometrical source size using a coalescence model [2]. Using this model, we can calculate the homogeneity volume from which antinuclei are produced, and this volume can be compared to the homogeneity volume extracted from two-particle (HBT) correlations. Figure 1 shows a comparison of the homogeneity volumes extracted from light antinuclei, and the corresponding HBT volumes, as a function of the transverse mass of the produced particles. The homogeneity volume decreases with transverse mass, indicating a smaller source size for particles of larger transverse mass. The pion HBT and antinucleus coalescence results follow a common mass systematic, indicating a simultaneous kinetic freeze-out for pions and antinucleons.

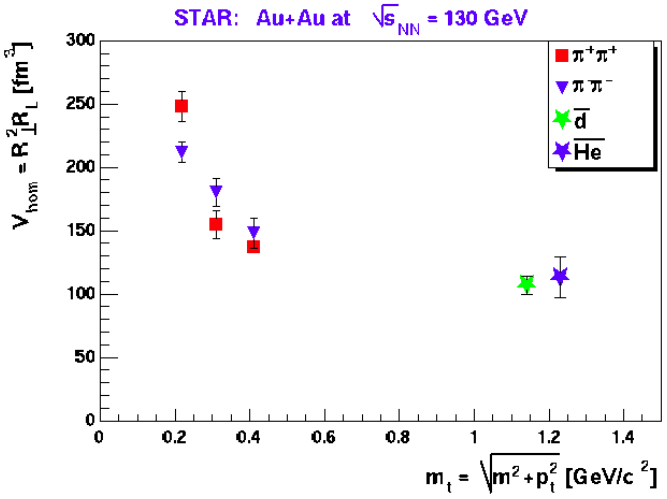

Figure 1. Homogeneity volume versus transverse mass for pions and antinuclei

We have also searched for evidence of antihypernucleus production in the year 1 STAR data. No antihypernuclei have been observed, but RHIC may provide a favorable environment for their production. The lightest antihypernucleus is the antihypertriton, an antiproton-antineutron-antilambda bound state. The antihypertriton should decay to an antihelion and pion 36% of the time with $c\tau = 7.3$cm. Using the measured yields of antinucleons, we expect and antihypertriton/antihelion ratio less than 0.9.

In the STAR data, we observe 29 antihelions. In these events, we have performed a topological search for the the decay antihypertriton->antihelion+pion. We observed several candidate decays at a level consistent with the mixed event background. From this, we can set an upper limit of antihypertriton/antihelion<1.4 (90% CL). This is well above the expected production level. With the much larger statistics available with year 2 STAR data (including a special Z=-2 trigger), we expect to make the first observation of the antihypertriton.

Footnotes and References

* Undergraduate Student from University of Pennsylvania

1. C. Adler, et al., Phys. Rev. Lett. 87, 262301 (2001).
2. R. Schiebl and U. Heinz, Phys. Rev. C 59, 1585 (1999).